REMARKS

This Amendment is filed in response to the Final Office Action dated August 11, 2008, along with a Request for Continued Prosecution (RCE) and associated fees. All objections and rejections are respectfully traversed.

Claims 1-48 are in the case.

Claims 1, 15, 32, and 38 have been amended to better claim the invention.

Claims 44-48 have been added to better claim the invention.

Request for Examiner Interview

The Applicant respectfully requests a telephonic interview with the Examiner after the Examiner has had an opportunity to consider this Amendment, but before issuance of the next Office Action. The Applicant's undersigned attorney may be reached at 617-951-2500.

Claim Rejections

At page 2 of the Final Office Action, the Examiner maintained the claim rejections under 35 U.S.C. §103 of the previous Office Action (of January 10, 2008). In that Office Action, all independent claims were rejected over various combinations of Carmignani et al. (U.S. Patent No. 6,524,447), Forsberg et al. (U.S. Patent No. 6,182,453), Engelhard et al. (U.S. Patent No. 6,461,520), German Reference DE 4228860 (hereinafter '860), Iana et al. (U.S. Patent No. 5,167,819), and Morrow et al. (U.S. Patent No. 6,712,414).

Applicant's claimed invention, represented in part by independent claim 15, as amended comprises (emphasis added):

15. A purification module for use with a wearable or portable hydrating fluid container, the purification module including

tubing for providing a path for the hydrating fluid from the container;

means for signaling when hydrating fluid is to flow along the path from the container through the tubing to a mouthpiece or orifice;

one or more solid state UV devices that are positioned in the path, either in the tubing, or in the region of the container that is shaped to join the tubing, or both, ***the UV devices providing UV radiation in a germicidal range to purify the flowing hydrating fluid, the UV devices turning on when the means for signaling signals hydrating fluid flow along the path through the tubing and reaching a state of UV output in the germicidal range to purify the hydrating fluid as the fluid flows through the tubing and turning off otherwise;*** and

a power supply that provides power to the purification module.

Carmignani teaches photocatalytic purification and disinfection/ultrapurification of water using an "open cell, three dimensionally reticulated, fluid permeable, semiconductor unit" (*see* Abstract). In Carmignani's disclosed systems, ultraviolet (UV) light may be applied in two separate manners. First, Carmignani teaches photocatalystic purification, in which UV light emitting diodes (LEDs, e.g., at 370nm or lower wavelength) may be used to illuminate a catalyst (e.g., Titanium Dioxide, TiO2) that performs organic destruction. Second, Carmignani teaches conventional photolysing using UV lamps:

> [Photolysing] requires deep UV irradiation (185 nm and 254 nm) using massed banks of UV lamps to decompose organics in water. The process is terribly inefficient, but is the only technology available to bring organic contamination down to marginally acceptable levels of 2-5 ppb. A common experience in the semiconductor industry is that at these levels, photolysing reaches a barrier at which point the curve of TOC versus total expended energy flattens out. (Col. 10, line 64 through Col. 11, line 4)

To reach the desired purity in Carmignani, photocatalysis and photolysing are used in combination (along with a mixed bed ion exchange or "MBIX"). In other words, Carmignani teaches a complex system of water purification <u>within a semiconductor unit</u>.

German Reference DE 4228860 ('860) teaches a container, e.g., water bottle, that has an associated power supply and UV lamps that may be used to sterilize the water <u>in the container</u> in a conventional manner.

Engelhard teaches a user-activated UV water treatment unit. There are two main problems addressed by Engelhard's disclosure, namely, 1) "ramp-up" time to activate a UV lamp to operational intensity, and 2) mechanical stresses on UV lamp filaments associated with the rapid increase in filament temperature upon activation of the lamp (*see* Col. 2, lines 34-58). Engelhard takes an interesting approach to these two problems by **increasing** the ramp-up time through a "soft-start circuit" to minimize stresses on the UV lamp filament during energization, and then balancing the effects of longer ramp-up (or conventional ramp-up) by employing a "time delay circuit." This time delay circuit prevents frequent on/off cycles by leaving the lamp illuminated for a period of time after user-controlled cessation, where:

> Furthermore, the time delay before shut off will irradiate the water remaining after completion of a water discharge to ensure that a subsequent water discharge during the ramp up of the [UV] lamp period will have been previously [fully] irradiated to kill microorganisms then present. (Col. 3, lines 6-11)

Engelhard, therefore, increases ramp-up time, where UV lamps are not fully operational, and adds a shut-off delay in order to irradiate water that would be subject to the next non-fully-operational ramp-up period.

In particular, Engelhard teaches a complex water purification apparatus or water treatment unit (in the general shape of a canister) to perform this function, whose physical description of the complex integrated parts without discussion of the time-sensitive operation begins at Column 3, line 66, and continues to Column 7. Specifically, features include passageways, angled outlets, conical shapes, etc. to direct the flow of water

through the maze of conduits in a helical swirling manner around the centrally located UV lamp and filter within the canister.

Also, Forsberg and Morrow merely teach power supplies, while Iana merely teaches wearable water pouches.

Applicant respectfully urges that none of the cited references teach Applicant's claimed novel ***solid state UV devices providing UV radiation in a germicidal range to purify the flowing hydrating fluid, the UV devices turning on when the means for signaling signals hydrating fluid flow along the path through the tubing and reaching a state of UV output in the germicidal range to purify the hydrating fluid as the fluid flows through the tubing and turning off otherwise***.

In particular, Applicant claims an intermittently operable fluid purification module using solid state UV devices (e.g., UV LEDs). Notably, Applicant is not merely claiming UV irradiation to purify water. Rather, Applicant is claiming the use of solid state UV devices between the fluid storage and a mouthpiece or orifice that turn on and off (e.g., "instantly") in response to flow of the fluid to purify the fluid <u>within the tubing</u> on-demand.

By intermittently using solid state UV devices (e.g., UV LEDs) to directly purify the water (i.e., not for photocatalysis), the claimed invention is more energy-efficient when compared to conventional UV lamp techniques described in the cited art.

Applicant wishes to direct the Examiner's attention to the following passage from Applicant's Specification:

> Unlike CCFL UV lamps, UV LEDs <u>are "instant on" devices meaning that UV output reaches steady state in micro or nanoseconds</u>. Also, unlike fragile CCFL UV lamps, UV LEDs are robust solid state devices which do not require low pressure gas mixtures that can leak and fail. In addition,

> UV LEDs are DC devices which require simple, low cost drive and control circuitry, as compared with the much more expensive and involved high voltage ballast circuitry of CCFL lamps.
>
> In a wearable flow-through hydration system, where water is drawn periodically and unpredictably, UV LED based purification has a further advantage over CCFL UV systems. With "instant on" and no need for a "ramp-up" period, and thus, the LEDs can be activated only as needed, i.e., while water is being drawn. When water is not being drawn, the LEDs are off and no power is consumed.
>
> (Applicant's Specification, page 4, lines 28 *et seq.*, emphasis added)

In addition, Applicant's claimed use of solid state UV devices along the tubing allows for a fluid purification design that does not require complex canisters or systems, and further allows for low-cost, energy-efficient fluid purification. Notably, it would not be possible to use conventional UV lamp technology as described in the cited art along the tubing of a portable hydration system. Specifically, due to the ramp-up of conventional UV lamps, a person may ingest contaminated fluid before lamps along the tubing would be at sufficient germicidal power if the lamps only turned on in response to flowing fluid. The "instant on" feature of solid state UV devices, which are turned on in response to the flow, therefore, allows for their placement along the tubing such that fluid flowing past the devices is purified prior to reaching the mouthpiece or orifice. (Also, solid state devices are less fragile than lamps, and are more suitable for portable, *wearable* hydration systems.)

Furthermore, by arranging the purification module along the tubing as claimed, the low power solid state UV devices (e.g., UV LEDs) may be positioned to adequately irradiate the fluid flowing through the tubing. Thus, the purification module along the tubing allows for energy efficiency (low power devices) without necessary complex designs of directing fluid though canisters as described in the cited art. In particular, the tubing provides an adequate environment for the efficient, low-power devices to be located within a proper proximity to the flowing fluid in order to provide a sufficient dose of UV radiation as the fluid flows through the tubing to the mouthpiece or other orifice.

Carmignani does not address activating UV radiation in response to fluid flow, nor to solid state UV devices along tubing between a bladder/container and a mouthpiece or orifice. Carmignani is focused on semiconductor manufacturing, which typically is unconcerned with power usage and conservation or the problems associated with ramp-up times. Also, as noted above, Carmignani does not use its UV LEDs to irradiate the water, but only to initiate photocatalysis on a catalytic substrate. Even Carmignani's passage related to UV LEDs to purify water in portable (battery powered) applications is directed to UV LEDs that photoactivate a catalyst (e.g., TiO_2), and <u>not</u> using the UV output itself to purify the water (*see* Col. 8, lines 27-46). In fact, Carmignani suggests that using a UV wavelength of 370nm or lower (UV-A range) may be shifted to a visible wavelength (i.e., *higher* than 370nm) which is a *more efficient use* of the LED energy (Col. 8, lines 30-34). Applicant's UV LEDs are meant specifically and solely to purify the water with a UV output *in the germicidal range* (e.g., UV-C range). The only mention of UV output in the germicidal range in Carmignani, thus Carmignani's teaching of UV radiation *in the germicidal range*, is solely with reference to conventional UV lamps, as noted above (Col. 10, line 64 through Col. 11, line 4). Carmignani also does not teach activating UV LEDs <u>in response to</u> the flow of fluid through the system, and has no mention of the UV devices being located along tubing between the source of the fluid and a mouthpiece or orifice.

Also, the German reference '860 does not mention UV LEDs, nor UV radiation in response to fluid flow. The '860 reference merely discusses using conventional UV lamps <u>in a water bottle</u>, and <u>not</u> along tubing and an associated path.

Furthermore, Engelhard also does not teach or suggest the novel features of Applicant's claimed invention. As noted above, Engelhard is focused on countering the side-effects of using UV lamps to purify water, i.e., rapid filament heating and inadequate

purification during ramp-up times. Engelhard does disclose the use of a flow sensor to activate the soft-start and delayed shut-off, but clearly the responsiveness to the flow sensor in Engelhard is vastly different from that of the Applicant's claimed invention. The purpose of Engelhard's invention is completely contrary to Applicant's, and, in fact, it would be wasteful *and dangerous* to apply the delayed on/off teachings of Engelhard to Applicant's claimed system. That is, Engelhard is directed to a system with UV lamps, and to operating the UV lamps in a manner that only makes sense when using UV lamps. In addition to not disclosing solid state UV devices, Engelhard is directed to a complex system for the purpose of water purification within a canister, where an added delay is specifically used to treat water left in the canister for the purpose of counteracting the increased UV lamp ramp-up time.

Applicant's claimed system places a solid state UV purification module along a path within tubing between a fluid container and a mouthpiece or orifice, and not within the fluid container or any other device with the purpose of storing water. In particular, in addition to a wearable bladder/mouthpiece embodiment, one of Applicant's claimed embodiments (claim 32 and dependent claim 47) allows for the tubing to be arranged as a portable drinking straw, clearly different from the complex canister design of Engelhard, which is most likely useful in a permanently affixed location such as a home or office (*see* Col 1, lines 27-28). Also, Applicant's claimed system, without the additional contraptions of Engelhard to direct the flow of water around the UV light, is therefore easier and less costly to manufacture than Engelhard's, and is more suitable for simplified portable water purification solutions, such as wearable water supplies having tubing from a bladder/container to a mouthpiece or orifice, accordingly.

Further, should someone be inclined to use the teachings of Engelhard for Applicant's claimed invention, namely attempting to put Engelhard's system into a portable hydration system's tubing, the *increased* ramp-up of a UV lamp would result in contaminated fluid reaching the mouthpiece or orifice, a dangerous result for the unfortunate user.

Again, as briefly noted above, Forsberg and Morrow merely teach power supplies, while Iana merely teaches wearable water pouches. None of either Forsberg, Morrow, or Iana teach or suggest using solid-state UV devices in a manner as claimed by Applicant.

Applicant respectfully urges, therefore, that the cited references are legally insufficient to render the claimed invention obvious under 35 U.S.C. §103 because of the absence from each of the cited references of Applicant's claimed novel ***solid state UV devices providing UV radiation in a germicidal range to purify the flowing hydrating fluid, the UV devices turning on when the means for signaling signals hydrating fluid flow along the path through the tubing and reaching a state of UV output in the germicidal range to purify the hydrating fluid as the fluid flows through the tubing and turning off otherwise***.

For the reasons described above, all independent claims are believed to be in condition for allowance.

All dependent claims are believed to be dependent from allowable independent claims, and therefore in condition for allowance.

Favorable action is respectfully solicited.

Please charge any fee occasioned by this paper to our Deposit Account No. 03-1237.

Respectfully submitted,

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